

Appl. No. 10/783,495
Amdt. Dated 08/25/2009
Suppl. Resp. to 05/01/2009 Offl action

Attorney Docket No.: N1085-00251
[TSMC2004-0834]

REMARKS/ARGUMENTS

Claims 1-2 and 3-22 were previously pending in this application and each was rejected in the May 1, 2009 final subject Office action.

5 The present paper is filed subsequent to the Response filed July 1, 2009, which included no claim amendments and did not result in the application being allowed.

An Advisory Action was mailed in this application, on July 17, 2009 and Applicants thank Examiner Norton for the detailed comments provided therein.

10 Applicants further thank Examiner Norton for the opportunity given their undersigned counsel, Mark J. Marcelli, to discuss the claimed invention in a telephonic Examiner interview with Examiner Norton that took place on August 6, 2009.

Claims 1 and 12, as amended in this paper, were discussed in the aforementioned Examiner interview.

Applicants respectfully request re-examination, reconsideration and allowance of each of pending claims 1 and 3-22.

15 I. **Claim Rejections based on the Park and Lensing references - 35 U.S.C. § 103**

20 In paragraph 7 of the May 1, 2009 Office action, claims 1, 3, 4 and 9-11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Park, U.S. Patent No. 6,825,912 in view of U.S. Patent No. 6,630,362 to Lensing, hereinafter "Lensing". In paragraph 14 of the May 1, 2009 Office action, claims 5-8 and 12-22 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Park in view of Lensing in further view of U.S. Patent No. 6,798,529 to Saka, et al. (hereinafter "Saka").

Applicants respectfully submit that each of these claim rejections is overcome for reasons set forth below.

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First and foremost, each of independent claims 1 and 12 is believed distinguished from Park in view of Lensing for reasons set forth in Applicants' previous Response dated July 1, 2009, i.e. one would not combine Park and Lensing and even if Park and Lensing were combined, the invention as recited in the claims pending on July 1, 2009, is distinguished from any combination of Park and Lensing. Since independent claims 1 and 12 were believed distinguished from Park in view of Lensing when in broader form prior to the present amendments (as discussed in the previously-submitted arguments filed July 1, 2009), the obviousness rejections under 35 U.S.C. § 103(a) should be withdrawn for at least these reasons.

Moreover, independent claim 1 has been amended and now recites the features of:

controlling the exposure energy with a feed forward process control signal of a compensation amount that compensates for thickness variations in a subjacent layer beneath a top layer, by combining the feed forward process control signal with the feedback process control signal to control the exposure energy used in patterning the top layer, and

the top layer being a non-photoresist layer.

Amended independent claim 12 recites:

a feed forward controller providing a feed forward control signal to an exposure apparatus based on a thickness measurement of an interlayer of the first patterned wafer substrate for controlling the exposure energy focused on a top layer of the first patterned wafer substrate, and . . .

the top layer being a non-photoresist layer.

In each of claims 1 and 12, the top layer is clearly distinguished from the subjacent layer: a subjacent layer beneath a top layer (claim 1); and interlayer layer ... and a top layer (claim 12). These layers are different, i.e. not the same layer, and THE TOP LAYER IS A NON-PHOTORESIST LAYER.

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5 Claim 1 clearly recites that it is the thickness variations in one layer, i.e. the subjacent layer, that is used for controlling the exposure energy used in patterning another layer, i.e., the top non-photoresist layer. Claim 12 clearly recites that it is the thickness measurement of one layer, i.e., the interlayer, that is used for controlling the exposure energy used in patterning a different layer, i.e., the top non-photoresist layer.

Applicants respectfully submit that Park does not teach the claimed feature of using a thickness variation or thickness of a first layer to control the exposure energy used in patterning a different layer.

10 In the aforementioned Examiner Interview, Examiner Norton indicated that she considered the photoresist layer of Park to be the "top" layer in order to reject the claims. In order to consider Park to satisfy the claim limitation of a thickness measurement or a thickness variation of one layer used to control the exposure energy used in patterning a different layer, the different layer in Park was considered to be the photoresist layer.

15 Addressing this scenario, as a first matter, Applicants respectfully submit that the photoresist layer is simply a sacrificial layer used in the patterning process and when it is stated "patterning a top layer" the convention in semiconductor manufacturing parlance is that the "top layer" is a top device layer, not the sacrificial medium used to pattern it. For example, if a SiN layer is formed on top of a substrate then patterned
20 (using photoresist) one would state that the top SiN layer as "being patterned", not the photoresist. Applicants would therefore argue that Park is limited to using a thickness or reflectivity measurement of a film to provide a feed forward signal used in patterning that same film, not another film formed over the measured film as in claim 1 or claim 12.

25 The semiconductor manufacturing convention notwithstanding, the Examiner correctly states that "a reflectivity is determined by the thickness and quality of substrate surface formed in the most recent pre-exposure step process" is used to control the

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exposure of the **photoresist** film formed over the "substrate surface formed in the most recent pre-exposure step process".

According to the Examiner's reasoning, the surface in the most recent pre-exposure step being the underlying layer, Park is limited to the *top* layer being
5 photoresist. (In essence, the thickness or reflectivity of the layer being patterned is used to control the exposure energy in the patterning of *that* layer or, according to the Examiner, to control the exposure energy used to pattern the photoresist layer used to pattern that layer.)

During the August 6, 2009 Examiner interview, Examiner Norton agreed that the
10 only "top" layer [in which the exposure energy thereof is controlled, as determined by a thickness of a lower layer], is a **photoresist** layer. Applicants thank Examiner Norton for agreeing that amended claims 1 and 12 are now distinguished from Park and Applicants respectfully further submit that claims 1 and 12 are therefore distinguished from Park in view of Lensing.

15 The Examiner acknowledged that amended claims 1 and 12 are distinguished from Park and Lensing has been relied upon for controlling the exposure energy as opposed to the exposure time as taught in Park, but Lensing does not make up for the above-stated and acknowledged deficiencies of Park.

Claims 1 and 12 are therefore distinguished from Park in view of Lensing, and
20 claims 3-11 and 13-22 are similarly distinguished by virtue of their respective dependencies.

In summary then, claims 1 and 12 are distinguished from Park in view of Lensing, and the obviousness rejections under 35 U.S.C. § 103(a) should be withdrawn at least because:

- 25
- A) The stated (and only) objective of the Park reference is to change exposure TIME. This reinforces the only plausible interpretation of Park. The Park reference therefore cannot be used to support an obviousness rejection

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based on modifying the Park reference to change the exposure *energy*, as such would be counterintuitive.

- B] Even if one did attempt to combine the Park and Lensing references, the claimed invention would not result because neither reference nor any combination thereof, teaches the claimed feature of using a signal based on thickness of a subjacent layer, when patterning a different layer, namely a top non-photoresist layer, as acknowledged by Examiner Norton.

The rejection of claims 1, 3, 4 and 9-11 under 35 U.S.C. § 103(a), should be withdrawn.

II. Claim Rejections based on the Park, Lensing and Saka references - 35 U.S.C. § 103

As above, claims 5-8 and 12-22 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Park in view of Lensing in further view of U.S. Patent No. 6,798,529 to Saka, et al. (hereinafter "Saka").

Claims 5-8 depend from claim 1, which is distinguished from Park and Lensing, as acknowledged by the Examiner, above. Claim 12 is an independent claim with claims 13-22 depending from claim 12. Claim 12 is also distinguished from Park as acknowledged by the Examiner, and distinguished from Park and Lensing, as above.

Saka has apparently been relied upon for an interlayer thickness measurement after chemical mechanical planarization. This does not make up for the above-stated deficiencies of Park in view of Lensing. Saka is not directed to controlling exposure energy. Saka, in fact, is not even directed to controlling the exposure process in any manner. Saka is directed to detecting endpoint in chemical mechanical polishing (CMP). In Saka, the control signals based on thickness measurements are only used to control the CMP apparatus and Saka monitors the thickness and reflectance of the layer being polished, i.e., removed, not a subjacent layer or another layer different than the one being processed, as in the claimed invention.

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Because Saka does not make up for the above-stated deficiencies of Park in view of Lensing, independent claims 1 and 12 and therefore also dependent claims 5-8 and 13-22, are distinguished from Park in view of Lensing and Saka.

The rejection of claims 5-8 and 13-22 under 35 U.S.C. § 103(a) as being unpatentable over Park in view of Lensing and Saka, should be withdrawn.

CONCLUSION

Based on the foregoing, each of pending claims 1 and 3-22 is in allowable form and the application in condition for allowance, which action is respectfully and expeditiously requested.

The Assistant Commissioner for Patents is hereby authorized to charge any fees necessary to give effect to this filing and to credit any excess payment that may be associated with this communication, to Deposit Account 04-1679.

Respectfully submitted,

Dated: August 25, 2009


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